



Missing Indexes

Do's and Don'ts

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- SQL Server DBA & DB Developer
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- Speaking since Early 2014
- Microsoft MVP (2017-2018)
- Chicago Suburban User Group Chapter Leader (former)
- Chicago SQL Association – Director-at-Large

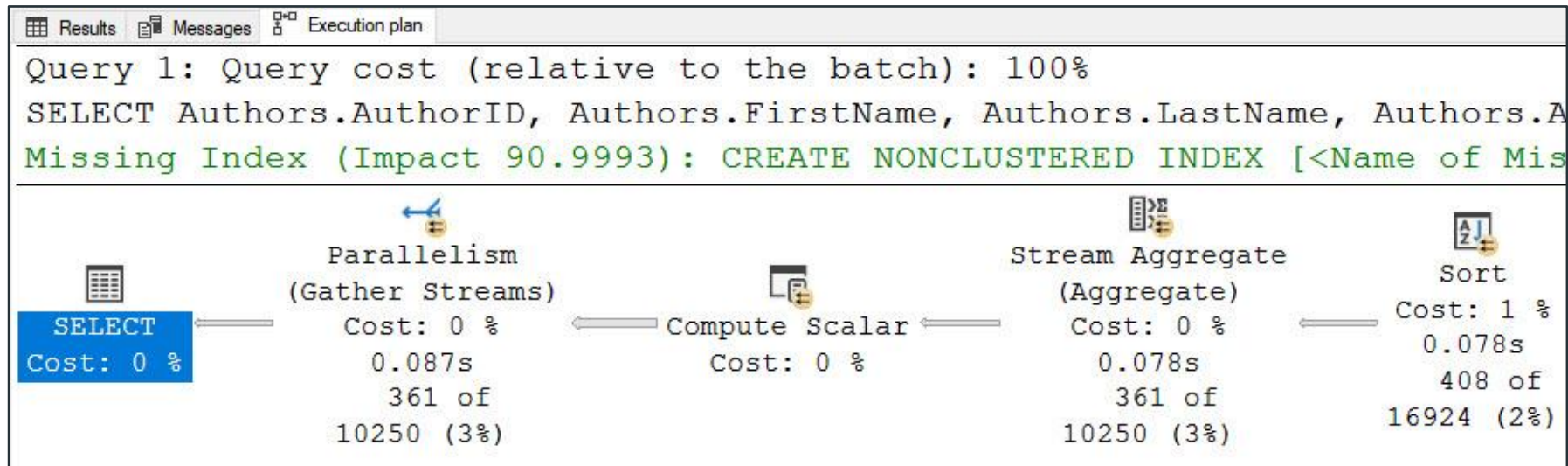


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What Do You Do When You See...?





“

*Ooo... this can help my
nasty query INSTANTLY!*

Apply it now!

A decorative network diagram at the top of the slide, featuring a series of interconnected nodes and lines. The nodes are represented by circles of varying sizes, some with concentric circles, and the lines are thin and grey. The diagram is centered horizontally and extends across the top of the slide.

“

*They're all
worthless garbage.*

A decorative network diagram at the top of the slide, featuring a complex web of interconnected nodes and lines. The nodes are represented by small circles, some of which are highlighted with larger, concentric circles. The lines connecting the nodes are thin and grey. The overall structure is a dense, interconnected mesh that spans the width of the slide.

“

To use...

Or not to use?

That is the question!

Today's Agenda

- ◎ Index Access Methods

- ◎ Inside a

200 Level Session

tion (MIR)

- ◎ Demo

Will **NOT** be teaching how
to craft the perfect index

A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines. The nodes are represented by small circles, some of which are larger and have concentric circles, suggesting a hierarchical or multi-layered structure. The lines are thin and gray, connecting the nodes in a non-linear fashion.

Index Access Methods

What You Need To Know

A decorative network diagram in the bottom-right corner, similar to the one in the top-left. It shows a cluster of nodes connected by lines, with some nodes being larger and more prominent than others, indicating a central or hub-like node in the network.

I Love A

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Search

Index Key Columns

1. Key Ingredient
2. Recipe Name

Included Columns

1. Page Number

Index Key Columns

1. Key Ingredient
2. Sub Category
3. Recipe Name

Included Columns

1. Recipe Type
2. Cook Time
3. Page Number

Pork

Chops

- Grilled w. mustard-sage sauce

- BBQ, 35 Min, 395

- Smothered w. cider & apples

- Dinner, 45 Min, 192

- Thick cut – Pan seared

- Dinner, 30 Min, 278

Ground

- Breakfast sausage patty

- Breakfast, 20 Min, 99

- Meatballs w. sweet & sour sauce

- Appetizer, 45 Min, 173

- Ravioli filling - Mild

- Pasta, 25 Min, 45

- Ravioli filling - Spicy

- Pasta, 30 Min, 46

Pork (cont.)

Loin

- Breaded cutlet - fried

- Dinner, 35 Min, 395

- Breaded nuggets - baked

- Appetizer, 45 Min, 192

- Roasted w. herbs

- Dinner, 75 Min, 71

- Stir fried – Cantonese style

- Dinner, 20 Min, 28

Ribs

- Baby-back – Memphis style

- BBQ, 360 Min, 143

- Spareribs – honey glazed

- Appetizer, 45 Min, 84

Index Key Columns

1. Key Ingredient
2. Sub Category
3. Recipe Name

Included Columns

1. Recipe Type
2. Cook Time
3. Page Number

Find:

Roasted pork
loin w. herbs

Pork

⦿ *Chops*

- Grilled w. mustard-sage sauce
 - BBQ, 35 Min, 395
- Smothered w. cider & apples
 - Dinner, 45 Min, 192
- Thick cut – Pan seared
 - Dinner, 30 Min, 278

⦿ *Ground*

- Breakfast sausage patty
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Pork (cont.)

⦿ *Loin*

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Index Key Columns

1. Key Ingredient
2. Sub Category
3. Recipe Name

Included Columns

1. Recipe Type
2. Cook Time
3. Page Number

Find:

Pork
appetizers

All ground
meat

Pork

Chops

- Grilled w. mustard-sage sauce
 - BBQ, 35 Min, 395
- Smothered w. cider & apples
 - Dinner, 45 Min, 192
- Thick cut – Pan seared
 - Dinner, 30 Min, 278

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Index Key Columns

1. Key Ingredient
2. Sub Category
3. Recipe Name

Included Columns

1. Recipe Type
2. Cook Time
3. Page Number

Find:

Ground pork
ravioli fillings

All pork loin

Pork

Chops

- Grilled w. mustard-sage sauce
 - BBQ, 35 Min, 395
- Smothered w. cider & apples
 - Dinner, 45 Min, 192
- Thick cut – Pan seared
 - Dinner, 30 Min, 278

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Index Key Columns

1. Key Ingredient
2. Sub Category
3. Recipe Name

Included Columns

1. Recipe Type
2. Cook Time
3. Page Number

Find:

Honey glazed
pork
spareribs
+ calories

Pork

Chops

- Grilled w. mustard-sage sauce
 - BBQ, 35 Min, 395
- Smothered w. cider & apples
 - Dinner, 45 Min, 192
- Thick cut – Pan seared
 - Dinner, 30 Min, 278

Ground

- Breakfast sausage patty
 - Breakfast, 20 Min, 99
- Meatballs w. sweet & sour sauce
 - Appetizer, 45 Min, 173
- Ravioli filling - Mild
 - Pasta, 25 Min, 45
- Ravioli filling - Spicy
 - Pasta, 30 Min, 46

Pork (cont.)

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 - Dinner, 35 Min, 395
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 - Appetizer, 45 Min, 192
- Roasted w. herbs
 - Dinner, 75 Min, 71
- Stir fried – Cantonese style
 - Dinner, 20 Min, 28

Ribs

- Baby-back – Memphis style
 - BBQ, 360 Min, 143
- Spareribs – honey glazed
 - Appetizer, 45 Min, 84

?

How Unique?

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Mussels; Scallops; Shrimp

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Remember

Be mindful of how Seeks &
Scans navigate an Index

Key Order & Cardinality
make a difference



A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines. The nodes are represented by small circles, some of which are larger and have concentric circles, suggesting different levels of connectivity or importance. The lines are thin and gray, creating a mesh-like structure.

Inside a Missing Index Recommendation

Let's Break It Down

A decorative network diagram in the bottom-right corner, similar to the one in the top-left, showing a cluster of nodes connected by lines, with some nodes highlighted by concentric circles.

A Missing Index Recommendation

```
1  /*
2  Missing Index Details from Missing Index Rec examples.sql -
    BISHOP.XMEN.COM.CookbookDemo (andy_local (61))
3  The Query Processor estimates that implementing the
    following index could improve the query cost by 90.9993%.
4  */
5
6  USE [CookbookDemo]
7  GO
8  CREATE NONCLUSTERED INDEX [<Name of Missing Index,
    sysname,>]
9  ON [dbo].[Reviews] ([Approved],[DateSubmitted])
10 INCLUDE ([AuthorID],[DateModified],[HelpfulScore])
11 GO
```

Meet the DMVs

- ◎ `sys.dm_db_missing_index_groups`
- ◎ `sys.dm_db_missing_index_group_stats`
- ◎ `sys.dm_db_missing_index_details`

Group Stats – Key Data Points

- ◎ Access Method Metrics
 - Seeks & Scans
- ◎ Costs & Impact metrics
 - Cost – raw value change
 - Impact – percent change

Name			
1	dm_db_missing_index_group_stats		
	Column_name	Type	Con
1	group_handle	int	no
2	unique_compiles	bigint	no
3	user_seeks	bigint	no
4	user_scans	bigint	no
5	last_user_seek	datetime	no
6	last_user_scan	datetime	no
7	avg_total_user_cost	float	no
8	avg_user_impact	float	no
9	system_seeks	bigint	no
10	system_scans	bigint	no
11	last_system_seek	datetime	no
12	last_system_scan	datetime	no
13	avg_total_system...	float	no
14	avg_system_impact	float	no

Details – Key Columns

- Equality columns
- Inequality columns
- Included columns

Name		
1	dm_db_missing_index_details	
	Column_name	Type
1	index_handle	int
2	database_id	smallint
3	object_id	int
4	equality_columns	nvarchar
5	inequality_columns	nvarchar
6	included_columns	nvarchar
7	statement	nvarchar

A decorative network diagram at the top of the slide, featuring a complex web of nodes and edges. A central node is highlighted with a dashed circle and a solid circle, containing a large blue quotation mark.

“

*Which queries generated
that recommendation?*

SQL Server 2019 to the Rescue!

- ◎ `sys.dm_db_missing_index_group_stats_query`
 - New in SQL Server 2019 & Azure SQL
 - Join back to `sys.dm_exec_sql_text()`
- ◎ Duplicates much of `index_details`
 - Lacks `unique_compiles`

A decorative network diagram at the top of the slide, featuring a complex web of interconnected nodes and lines. A central node is highlighted with a dashed circle and contains a large blue quotation mark.

“

*That's powerful
information!*

What's the downside?

Caveats

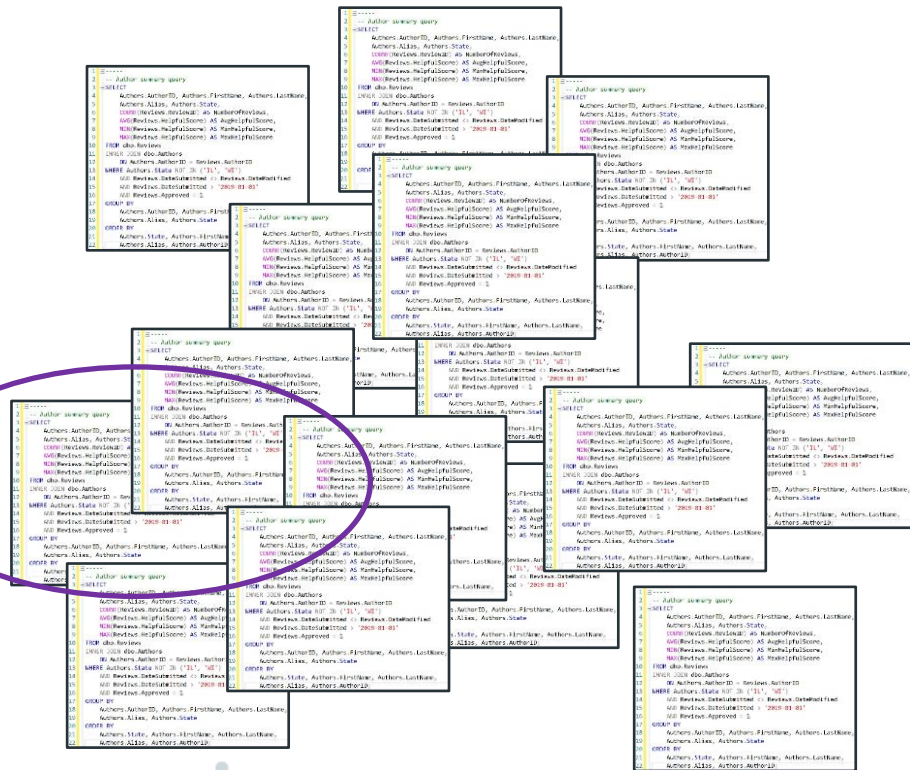
- ◎ Inequality columns
- ◎ Recommendation column order
- ◎ 1 Missing Index Rec -> 1 **Execution Plan**
 - *NOT Query*
 - *Based on the ESTIMATED plan*

Even More Drawbacks:

[https://docs.microsoft.com/en-us/previous-versions/sql/sql-server-2008-r2/ms345485\(v=sql.105\)](https://docs.microsoft.com/en-us/previous-versions/sql/sql-server-2008-r2/ms345485(v=sql.105))

Think About Scope

```
1  -----
2  -- Author summary query
3  SELECT
4      Authors.AuthorID, Authors.FirstName, Authors.LastName,
5      Authors.Alias, Authors.State,
6      COUNT(Reviews.ReviewID) AS NumberOfReviews,
7      AVG(Reviews.HelpfulScore) AS AvgHelpfulScore,
8      MIN(Reviews.HelpfulScore) AS MinHelpfulScore,
9      MAX(Reviews.HelpfulScore) AS MaxHelpfulScore
10 FROM dbo.Reviews
11 INNER JOIN dbo.Authors
12     ON Authors.AuthorID = Reviews.AuthorID
13 WHERE Authors.State NOT IN ('IL', 'WI')
14     AND Reviews.DateSubmitted <> Reviews.DateModified
15     AND Reviews.DateSubmitted > '2019-01-01'
16     AND Reviews.Approved = 1
17 GROUP BY
18     Authors.AuthorID, Authors.FirstName, Authors.LastName,
19     Authors.Alias, Authors.State
20 ORDER BY
21     Authors.State, Authors.FirstName, Authors.LastName,
22     Authors.Alias, Authors.AuthorID;
```



Remember

Consider factors like scope,
frequency, and context
when evaluating a Missing
Index Recommendation





Demo

Two More Demos

- ◎ Workload Analysis

- youtube.com/watch?v=JPIL_Vq3gHc&t=3297s

- ◎ Plan Explorer: Index Analysis

- youtube.com/watch?v=JPIL_Vq3gHc&t=3846s

Parting Thoughts: *Do & Don't*

Don't

- ◎ Take a MIR at face value

Do

- ◎ Consider:
 - Context
 - Frequency
 - Your Data



Learn More: Resources

Erik Darling – Multiple blogs (search keyword”missing”)

<https://www.erikdarlingdata.com/category/indexing/>

Are your indexing strategies working? – Kimberly Tripp Randal

<https://www.sqlskills.com/blogs/kimberly/the-accidental-dba-day-20-of-30-are-your-indexing-strategies-working-aka-indexing-dmvs/>

Missing Index Recommendations Aren’t Perfect - Brent Ozar

<https://www.brentozar.com/archive/2017/08/missing-index-recommendations-arent-perfect/>

Don’t Just Blindly Create those Missing Indexes - Aaron Bertrand


<https://sqlperformance.com/2013/06/t-sql-queries/missing-index>

It’s Not You, It’s Me (I/O Troubleshooting) – Monica Rathbun

<https://sqlperformance.com/2017/04/sql-performance/its-not-you-its-me>

Digging into the SQL Plan Cache: Finding Missing Indexes - Jonathan Kehayias

<https://www.sqlskills.com/blogs/jonathan/digging-into-the-sql-plan-cache-finding-missing-indexes/>



Thank You!

Any Questions?

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Special thanks to all the people who made and
released these awesome resources for free:
Presentation template by [SlidesCarnival](#)
Photographs by [Unsplash](#)